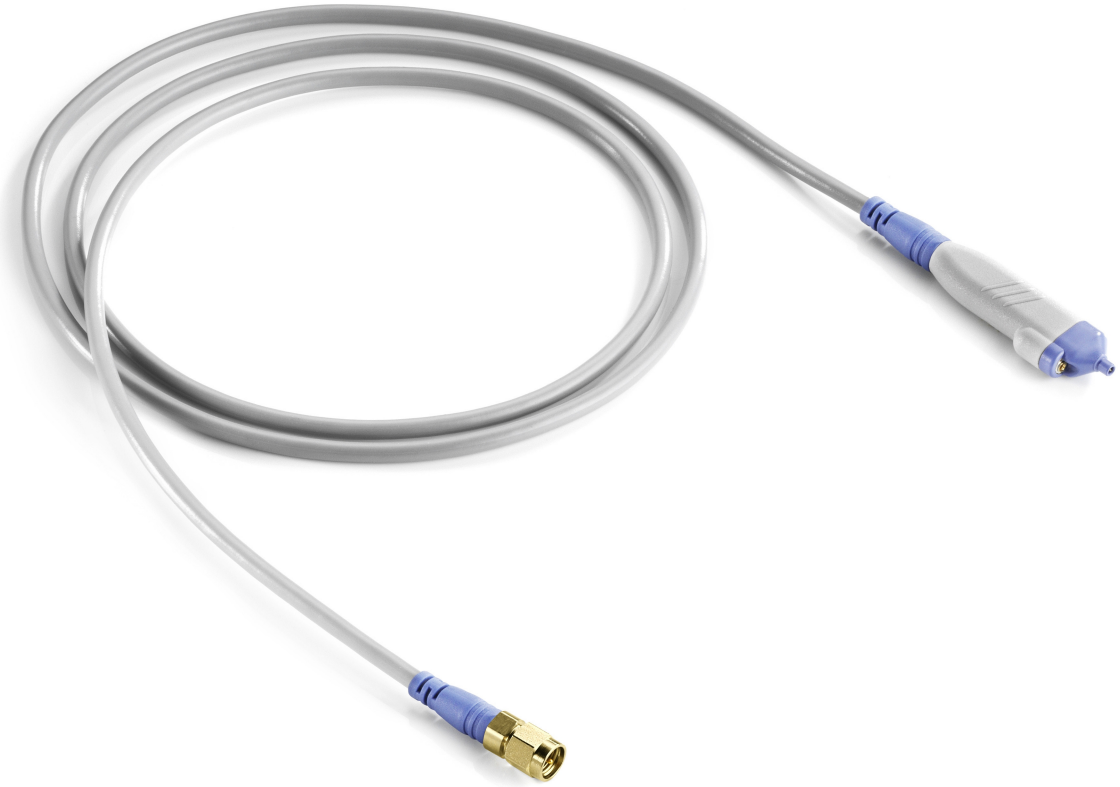
R&S®RT-ZZ80
Transmission Line Probe
User Manual



1409.7689.02 ─ 01

ROHDE&SCHWARZ

Test & Measurement

User Manual

This User Manual describes the following R&S®RT-ZZ models and options:

- R&S®RT-ZZ80 (1409.7608.02)

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The following abbreviations are used in this manual: R&S®RT-ZZ80 is abbreviated as R&S RT-ZZ80. R&S®RTO is abbreviated as R&S RTO.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the EC Certificate of Conformity and has left the manufacturer’s plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any purpose other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

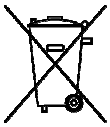
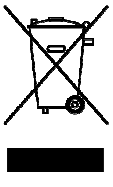
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments,

systems and all accessories. For product-specific information, see the data sheet and the product documentation.

Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation		ON/OFF supply voltage
	Caution when handling heavy equipment		Standby indication
	Danger of electric shock		Direct current (DC)
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additonal information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates information considered important, but not hazard-related, e.g. messages relating to property damage. In the product documentation, the word ATTENTION is used synonymously.

These signal words are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   predefined operating position is always with the housing floor facing down, IP protection 2X, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency, overvoltage category 2, pollution severity 2.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

Electrical safety

If the information on electrical safety is not observed either at all or to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If there is no power switch for disconnecting the product from the AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.

5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.

16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
   - Class A equipment:
     Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings
     Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
   - Class B equipment:
     Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
5. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
6. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
7. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons,

etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately. Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

For additional information about environmental protection, visit the Rohde & Schwarz website.

Instrucciones de seguridad elementales

¡Es imprescindible leer y cumplir las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

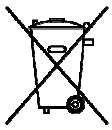
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

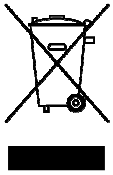
Instrucciones de seguridad elementales

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.

⚠ PELIGRO — Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.

⚠ ADVERTENCIA — Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.

⚠ ATENCIÓN — Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.

AVISO — Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.
En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue:
   como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, se pueden causar lesiones o, en determinadas circunstancias, incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.

2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión.
   El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m).
   Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

Instrucciones de seguridad elementales

10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   - Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
   - Aparato de clase B:
     Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
6. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado. Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish.
We will take care that you will get the right information.

Europe, Africa, Middle East	Phone +49 89 4129 12345 customersupport@rohde-schwarz.com
North America	Phone 1-888-TEST-RSA (1-888-837-8772) customer.support@rsa.rohde-schwarz.com
Latin America	Phone +1-410-910-7988 customersupport.la@rohde-schwarz.com
Asia/Pacific	Phone +65 65 13 04 88 customersupport.asia@rohde-schwarz.com
China	Phone +86-800-810-8228 / +86-400-650-5896 customersupport.china@rohde-schwarz.com

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1 Product Description

1.1 Safety Instructions for R&S RT-ZZ80

When handling R&S RT-ZZ80 transmission line probes, the following basic rules must be observed. Prior to using a probe, read the applicable manual including the safety instructions. Keep the safety instructions and the product documentation in a safe place and pass them on to other users. Use the R&S RT-ZZ80 exclusively within the measurement ranges specified in the applicable data sheets. Rohde & Schwarz accepts no responsibility for misuse of the product. Use only the accessories supplied with the R&S RT-ZZ80.

⚠ WARNING

Risk of electric shock

Do not connect an R&S RT-ZZ80 to any voltage that exceeds the maximum permissible input voltage specified in the data sheet. Non-compliance with this instruction carries the risk of an electric shock.

Make sure not to cause any short circuits when performing measurements on sources with high output currents. Short circuits may cause injuries or burns.

⚠ CAUTION

Risk of injury caused by pointed object

The pins of the probe are extremely pointed and can easily penetrate clothes and the skin.

Therefore, handle the probe pins with great care. When transporting the probe, e.g. when carrying it in a pocket or tool bag, always use the box supplied with the probe. To exchange a probe pin, use tweezers or pliers to avoid injuries.

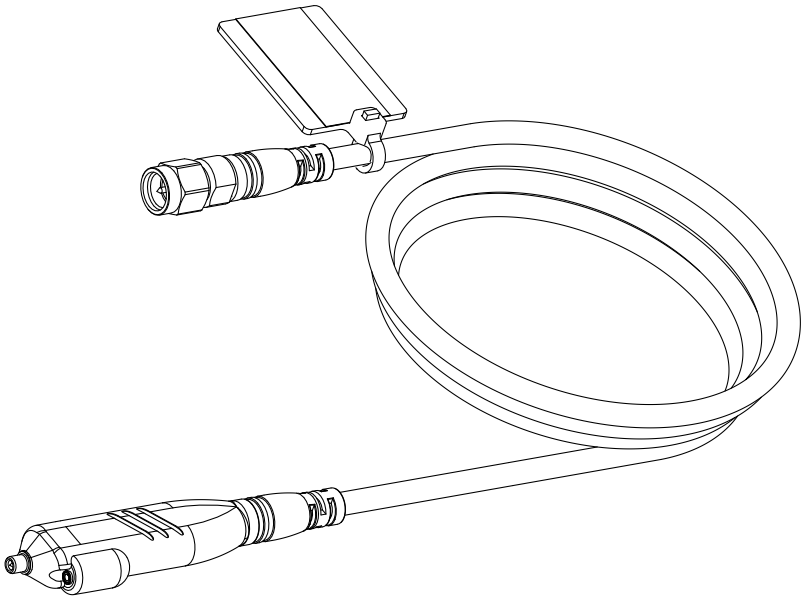
1.2 Key Features and Key Characteristics

Transmission line probes like R&S RT-ZZ80 are a special type of passive probes. They are based on an impedance controlled microwave cable (transmission line), which is terminated into a 50 Ω input impedance of the measuring instrument.

Compared to standard passive probes, the main differences of transmission line probes are:

- Higher bandwidth
- Higher input impedance at high frequencies
- Lower input impedance at DC

Thus transmission line probes are best suited for measurements of broadband single-ended signals in impedance controlled environments, for example, 50 Ω lines.



The R&S RT-ZZ80 has a wide dynamic range. High input levels up to 20 V (RMS) can be measured without distortion. The low inherent noise enables the measurement of small input signals.

The comprehensive accessory set allows this probe to be connected to a wide variety of devices under test (DUT) without impairing the very high bandwidth, short rise time and the low input capacitance of the R&S RT-ZZ80.

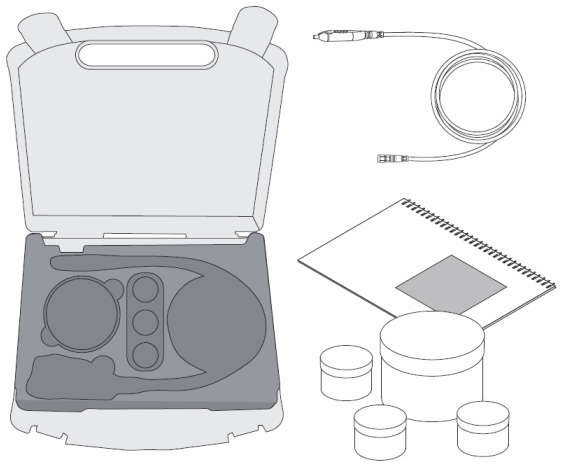
The R&S RT-ZZ80 has a standard SMA connector. For BNC input terminals the BNC to SMA adapter R&S RT-ZA10 is delivered with the probe. Thus the probe can be connected to any Rohde & Schwarz oscilloscope and to most other high-frequency measuring instruments.

The key characteristics of the probe are the following:

Bandwidth	DC to 8 GHz
Maximum input voltage	20 V (RMS)
Input resistance	500 Ω
Input capacitance	0.3 pF
Full dynamic range over the entire frequency range	
No harmonic distortions	
Negligible noise contribution	
Standard SMA connector	

1.3 Unpacking the Instrument

The carrying case contains the following items:



- R&S RT-ZZ80 transmission line probe
- Carrying case
- Accessory vials
- User manual
- R&S RT-ZZ80 data sheet
- Calibration certificate
- Documentation of calibration values (if ordered)

1.3.1 Inspecting the Contents

- Inspect the package for damage.
  Keep a damaged package and the cushioning material until the contents have been checked for completeness and the instrument has been tested.
  If the packaging material shows any signs of stress, notify the carrier as well as your Rohde & Schwarz service center. Keep the package and cushioning material for inspection.
- Inspect the probe.
  If there is any damage or defect, or if the R&S RT-ZZ80 transmission line probe does not operate properly, notify your Rohde & Schwarz service center.
- Inspect the accessories.
  If the contents are incomplete or damaged, notify your Rohde & Schwarz service center.
  Accessories supplied with the instrument are listed in chapter 1.5.1, "Accessories Supplied", on page 11.

1.4 Description of the Probe

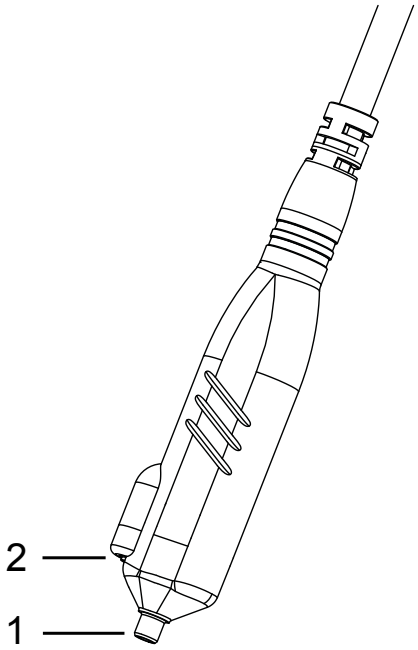
The probe consists of the probe head for connection to the DUT, the probe cable, and the SMA connector.

Probe connection:

- To a base unit with SMA inputs: direct connection
- To a base unit with BNC connectors: using the SMA to BNC adapter delivered with the probe

1.4.1 Probe Head

The small and lightweight probe head is designed for easy handling and high-performance measurements. The probe head is used for connecting the probe and the DUT. Different accessories for the signal and ground sockets allow the probe head to be connected to a wide range of DUTs.



(1) Signal socket

(2) Ground socket

The accessories supplied for the probe head sockets are listed in chapter 1.5.1, "Accessories Supplied", on page 11.

The ground socket is compatible with 0.64 mm (25 mil) square pins and 0.6 mm to 0.8 mm (24 mil to 35 mil) round pins.

NOTICE

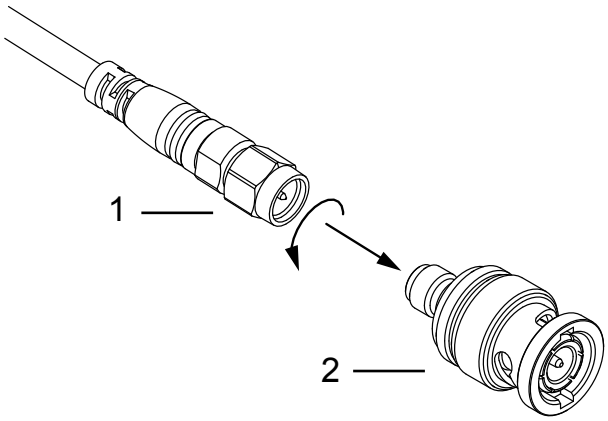
Special accessories for signal socket

The signal socket of the R&S RT-ZZ80 has a special design to ensure optimal performance. The signal socket is *not* compatible to standard accessories based on 0.64 mm (25 mil) square pins or 0.8 mm (35 mil) round pins. Use only special accessories for R&S RT-ZZ80 provided by Rohde & Schwarz.

1.4.2 SMA Connector and SMA to BNC Adapter

The R&S RT-ZZ80 has an SMA male connector for connection to the instrument. To connect the probe to an Rohde & Schwarz oscilloscope, for example, to an R&S RTO, you need the SMA to BNC adapter that is delivered with the probe. Screw the SMA connector on the SMA to BNC adapter as shown below.

► Use a torque wrench to tighten the SMA connector.



(1) SMA connector
(2) SMA to BNC adapter

1.5 Accessories and Items

The figure below shows all accessories that are available for the R&S RT-ZZ80 transmission line probe.

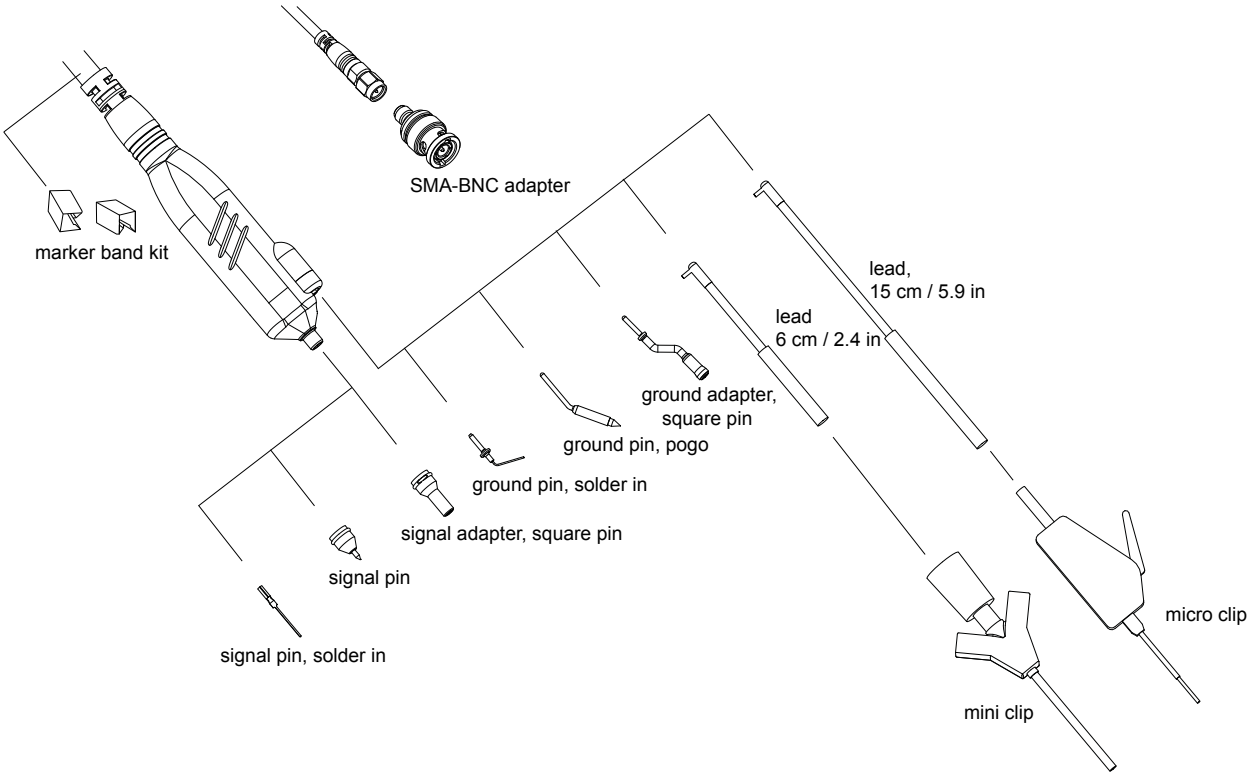


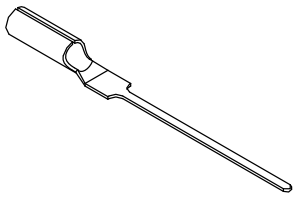
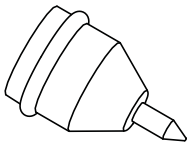
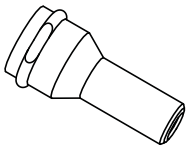
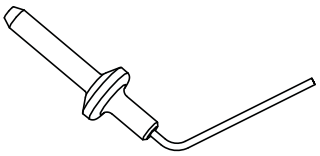
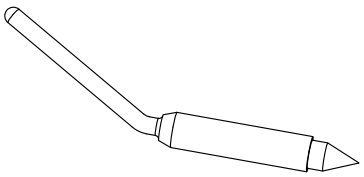
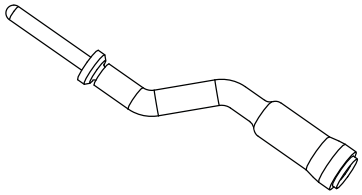
Fig. 1-1: Available accessories

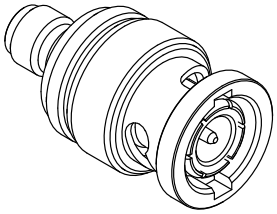
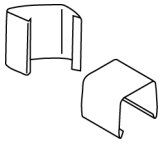
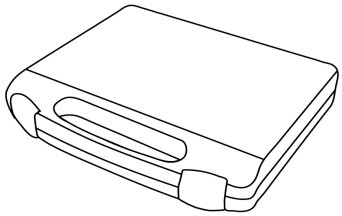
Leads, mini clip and micro clip are not included in the delivery.

1.5.1 Accessories Supplied

The following table shows the accessories supplied with the R&S RT-ZZ80 transmission line probe.

Table 1-1: Accessories supplied

Item	Quantity	Description
	50	Signal pin, solder in
	2	Signal pin
	2	Signal adapter, square pin
	10	Ground pin, solder in
	2	Ground pin, pogo
	2	Ground adapter, square pin

Item	Quantity	Description
	1	R&S RT-ZA10 SMA (female) to BNC (male) adapter
	1	Marker band kit
	1	Carrying case with foam inlay

1.5.2 Optional Accessories

If the included accessories do not meet individual customer requirements, Rohde & Schwarz offers different accessory sets for sale.

Table 1-2: R&S RT-ZA4 Mini Clips

Item	Quantity	Description
Mini clip	10	This set contains mini clips.

Table 1-3: R&S RT-ZA5 Micro Clips

Item	Quantity	Description
Micro clip	4	This set contains micro clips.

Table 1-4: R&S RT-ZA6 Lead Set

Item	Quantity	Description
Lead, 6 cm / 2.4 in Lead, 15 cm / 5.9 in	5 5	This set contains short and long leads.

1.5.3 Service Accessories

The following accessories are optionally available for servicing the probe.

Table 1-5: R&S RT-ZK2 Service Kit

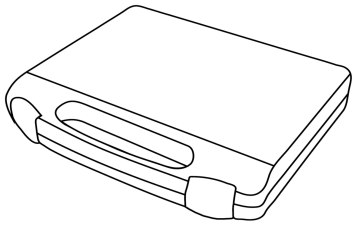
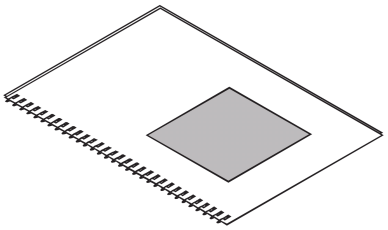
	The R&S RT-ZK2 Service Kit is used for calibrating the R&S RT-ZZ80 transmission line probe, for making performance tests and for servicing. The service kit includes all adapters and accessories to connect the probe to the required measuring instruments. The R&S RT-ZZ80 Service Manual is included in the service kit CD-ROM.

Table 1-6: R&S RT-ZZ80 Service Manual

	The Service Manual contains a detailed description of the performance test for verifying the probe specifications.

All service accessories and items can be ordered from your Rohde & Schwarz service center.

2 Putting into Operation

The R&S RT-ZZ80 transmission line probe has been designed to withstand a moderate amount of physical and electrical stress. You should treat the probe with care. It can be damaged if excessive force is applied to the probe tip.

NOTICE

Exercise care to prevent the probe from receiving mechanical shock.

Avoid putting excessive strain on the probe cable or exposing it to sharp bends.

Store the probe in a shock-resistant case such as the foam-lined shipping case that came with the probe.

NOTICE

Voltages above the specified limits of the R&S RT-ZZ80 transmission line probe may damage the probe.

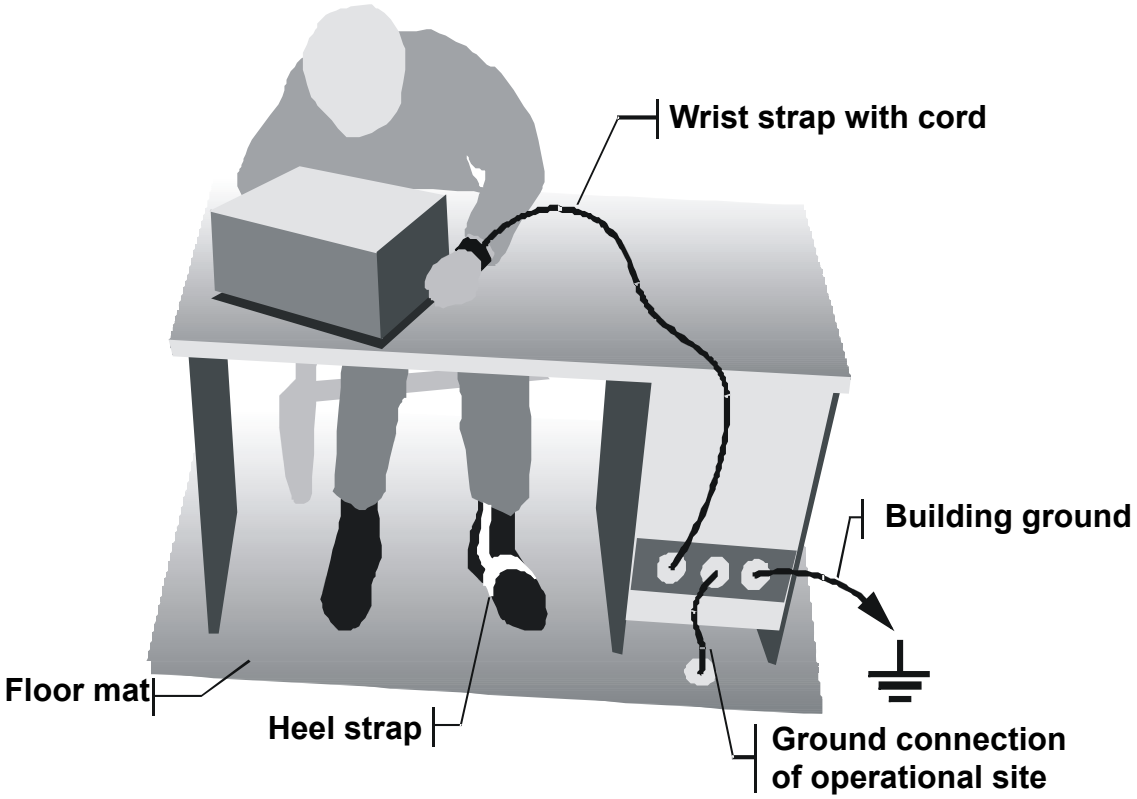
Do not exceed the specified limits.

During operation, the probe may heat up slightly. This is normal behavior and not a sign of malfunction.

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



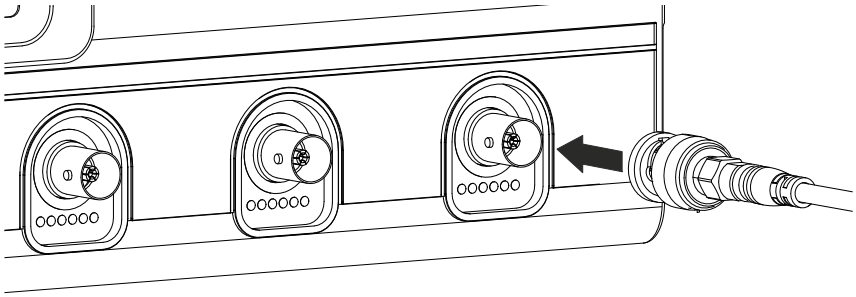
The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

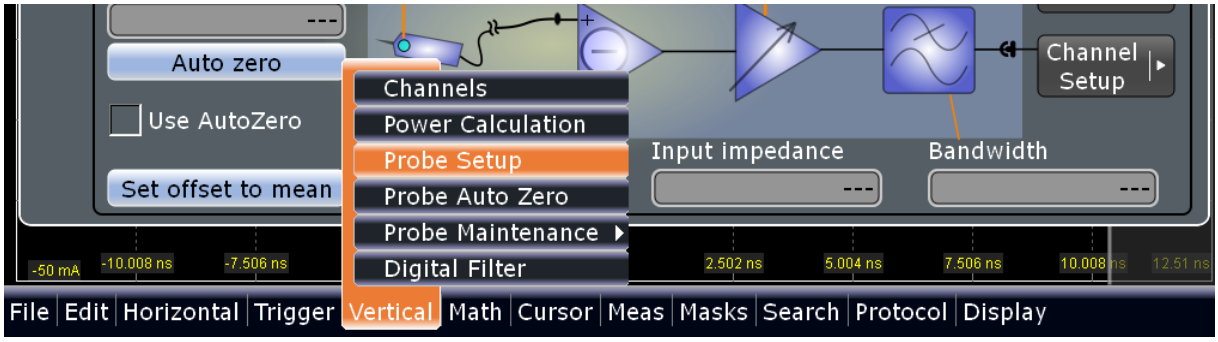
2.1 Connecting the Probe to the R&S RTO Oscilloscope

The R&S RT-ZZ80 transmission line probe has been designed for use with R&S RTO oscilloscopes.

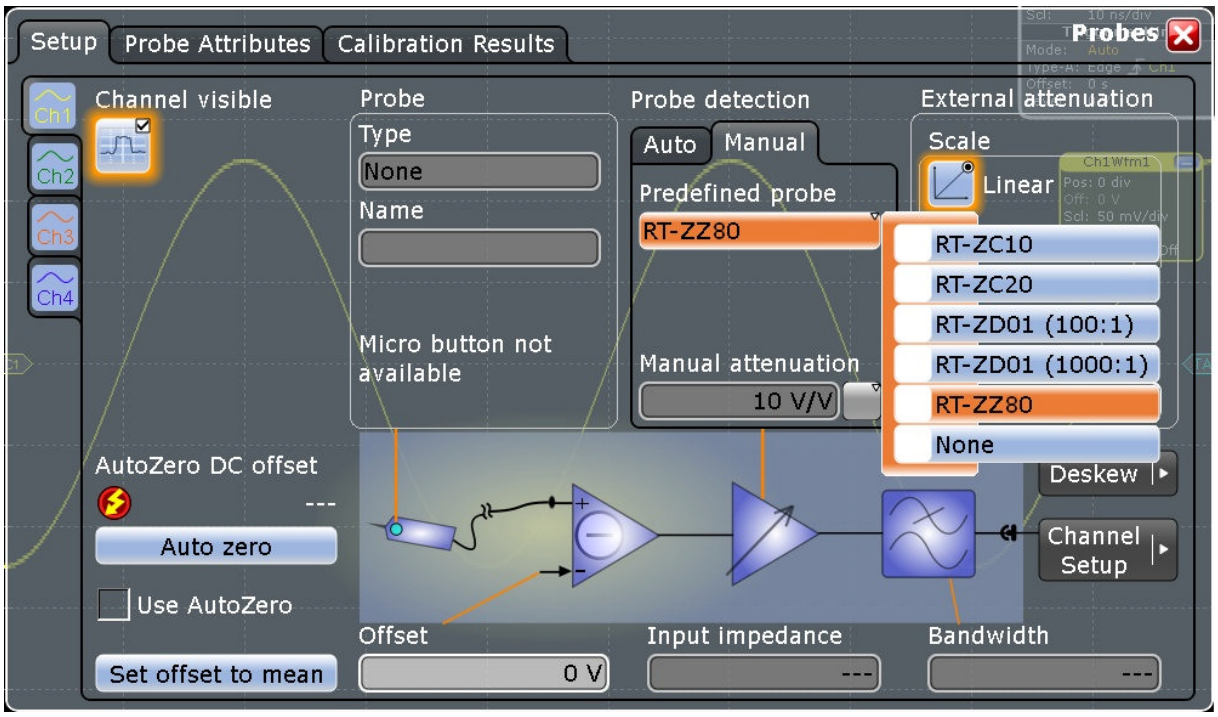
1. Connect the SMA connector of the probe to the SMA to BNC adapter, see chapter 1.4.2, "SMA Connector and SMA to BNC Adapter", on page 9.
2. Connect the SMA to BNC adapter to one of the BNC input connectors of the oscilloscope. Turn the collar until it clicks, and check that it is locked securely.



3. On the "Vertical" menu of the R&S RTO, select "Probe Setup".



4. Under "Probe detection", select the "Manual" tab.
   Select the "Predefined probe": "RT-ZZ80".



If you use another oscilloscope, make sure to configure the following settings:

- Input impedance of the channel = 50 Ω
- Unit = V
- Attenuation = 10 : 1

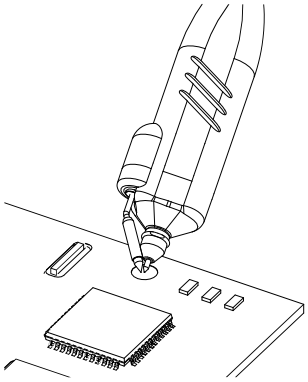
2.2 Auto Zero

The auto zero procedure performs an automatic correction of the zero error displayed on the oscilloscope's screen. The waveform is set to 0 V on the horizontal centerline of the oscilloscope.

The R&S RT-ZZ80 has no zero error. However, differences in DUT and oscilloscope ground levels may cause zero errors to be displayed on the oscilloscope's screen. If the DUT is not floating but ground-referenced, an auto zero routine may improve the measurement results.

1. Connect the probe to the R&S RTO oscilloscope and configure the probe as described in chapter 2.1, "Connecting the Probe to the R&S RTO Oscilloscope", on page 16.

2. Short the signal pin and the ground pin together and connect them to the ground of the DUT.



3. Start the auto zero procedure on the R&S RTO:
"Vertical" menu > "Probe Setup" > "Ch" tab > "Auto zero"

3 Connecting the Probe to the DUT

This chapter describes the different ways of connecting the probe to the DUT. In addition, the accessories supplied are described and their use is explained.

In order to achieve optimum RF performance, the connections should always be as short as possible. If long connections cannot be avoided, they should preferably be used for the ground socket.

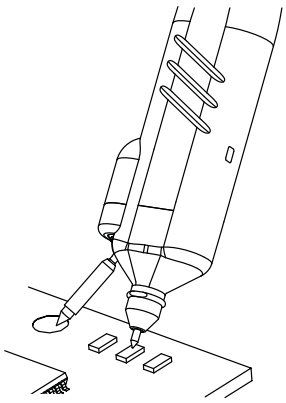
⚠ CAUTION

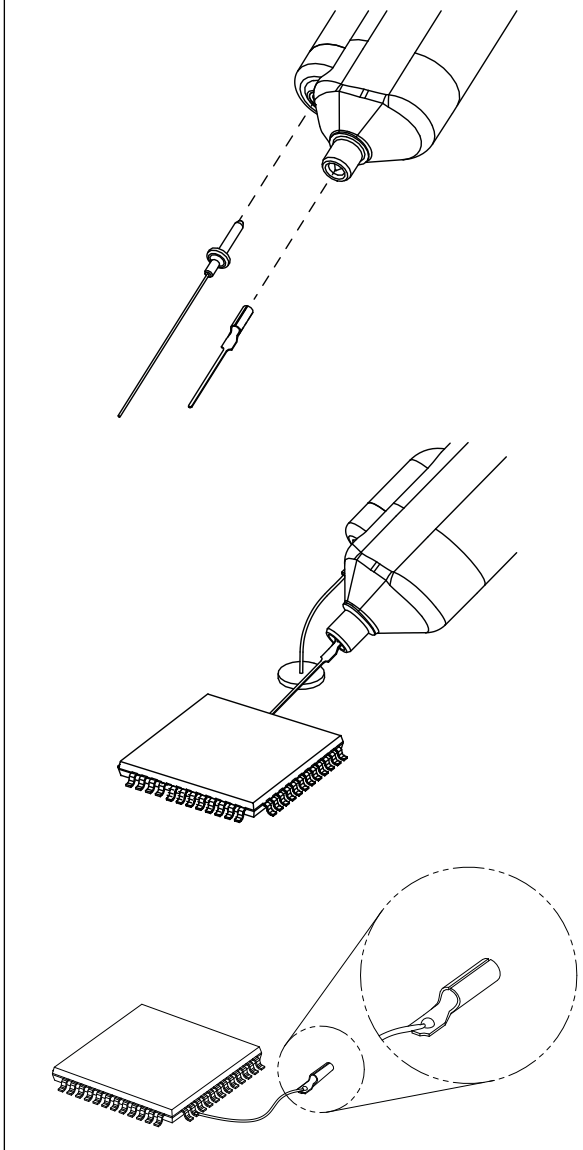
Risk of injuries

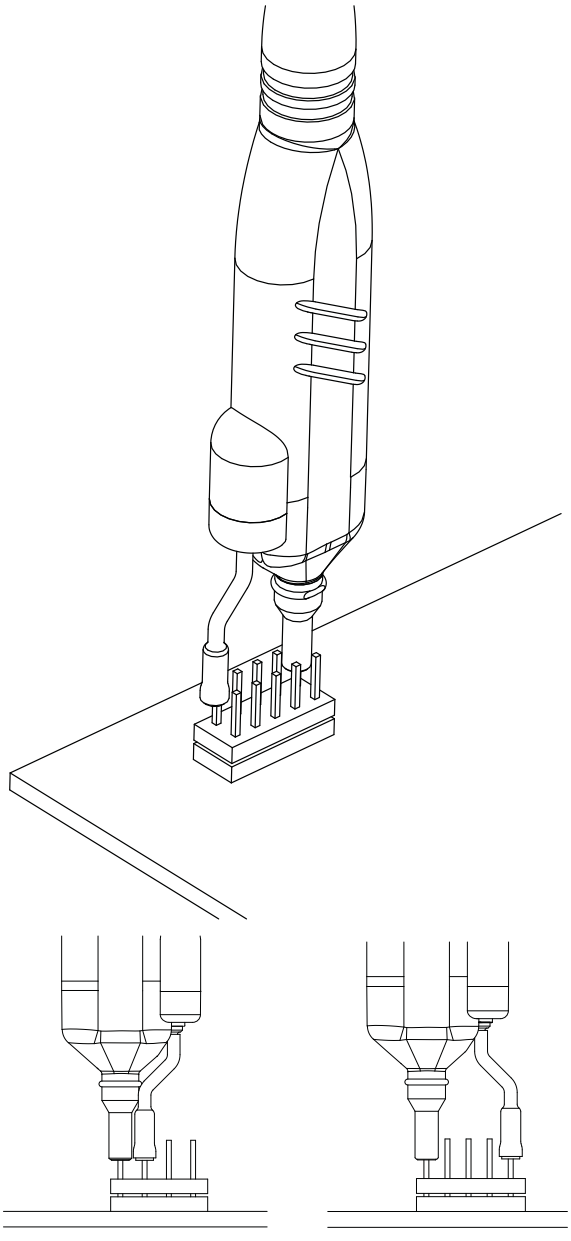
The included probe pins are exceptionally sharp and must be handled with extreme care. To prevent injuries, always use tweezers when inserting or removing pins.

Some solder-in accessories are very fine and sensitive. The probe should be stabilized by using appropriate means (e.g. adhesive tape, probe positioner) in order to protect the solder joint from excessive mechanical stress.

Pins

Signal pin and ground pin, pogo	
	Using the signal pin and ground pin, manual measurements can be performed without or with only minor limitation of the measurement bandwith. Best results are achieved if the distance between signal and ground is small. Even with maximum distance, rise times shorter than 55 ps can be reached. Because the spring-loaded ground pin compensates for minor unevenness and movements, this pin can establish a firm contact with the test point. It fits into the ground socket of the probe head. The distance to the signal pin can be varied by turning the ground pin. Distance range: 0 mm to 10 mm (0 mil to 400 mil)

Signal pin, solder in, and ground pin, solder-in	
	Using two solder-in pins for ground and signal, the R&S RT-ZZ80 is soldered directly into the circuit. The pins can be exchanged on the probe and can remain in the circuit. Thus, you can plug the probe on different test points. Use tweezers to insert the solder-in pins into the sockets on the probe, and then cut to the appropriate length. Keep the pins as short as possible. The fine wires on this adapter are best suited to make secure contact with small contact points, such as SMT components or IC pins. Alternatively, the signal pin has a solder tail for direct soldering of wires. Distance range: 0 mm to 20 mm (0 mil to 800 mil)

Signal adapter, square pin, and ground adapter, square pin	
	Using two square-in pin adapters for ground and signal, the probe can be connected directly to a pin strip. The sockets are compatible with 0.64 mm (25 mil) square pins and 0.6 mm to 0.8 mm (24 mil to 35 mil) round pins. The distance between the signal and ground adapter can be adjusted by turning the ground adapter. Distance range: 2.54 mm to 10.16 mm (1000 mil to 400 mil)

4 Measurement Principles

The R&S RT-ZZ80 transmission line probe provides an electrical connection between the DUT and the oscilloscope. The probe transfers the voltage of the electrical signal tapped off the DUT to the oscilloscope, where it is displayed graphically. Although a probe has a wide variety of specifications, these specifications can be grouped into two classes of basic requirements:

- High signal integrity of the transferred signal:
  With an ideal probe, the output signal that is transferred to the base unit would be identical to the input signal between the probe tips, and signal integrity would be extremely high. Every real probe, however, will transfer the input signal in altered form. A good probe causes only minimum alterations.
  How the probe can fulfill this requirement is mainly determined by its bandwidth.
- Acceptable loading of the input signal:
  Every probe is a load for the signal to be measured. This means that the signal to be measured changes as soon as the probe is connected. A good probe should cause a minimum change to the signal, also at higher frequencies.
  How the probe can fulfill this requirement is mainly determined by its input impedance.

The parameters of a probe are usually specified for a minimally short connection between the probe and the DUT. With longer connections, the connection inductance has a significant effect on the measurement.

The high-frequency behavior of probes is typically characterized in a 50 Ω measurement environment. The probe is connected to a 50 Ω line that is fed by a source with 50 Ω internal impedance and that is terminated into 50 Ω.

The figure 4-1 shows the equivalent circuit model of a probe that is connected to the DUT.

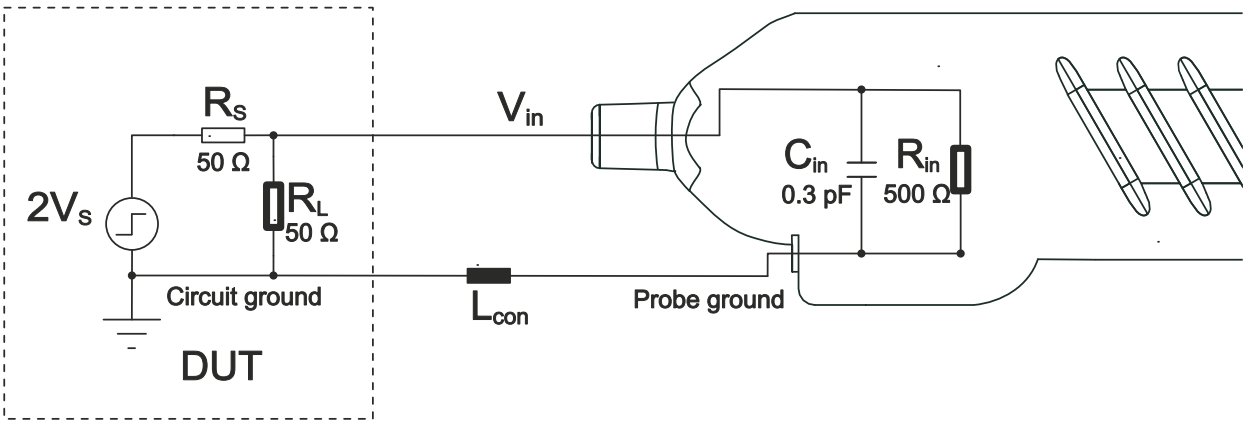


Fig. 4-1: Equivalent circuit model of the R&S RT-ZZ80 probe

Table 4-1: Designations

Abbreviation	Description
V_S	Voltage at the test point without probe connected
V_{in}	Voltage at the test point with probe connected, corresponds to the input voltage of the probe
R_S	Source resistance of the DUT
R_L	Load resistance of the DUT
R_{in}	Input resistance of the probe
C_{in}	Input capacitance of the probe
L_{con}	Connection inductance, depends on the type of connection

In a 50 Ω system, the output resistance of the source, the load resistance of the DUT and the characteristic impedance of all lines equal exactly 50 Ω. However, the behavior of the probe in the circuit is determined by the effective source impedance which is the impedance present in the DUT between the probe tip and ground.

Effective source impedance:

$$R'_S = R_S \parallel R_L = 25\,\Omega$$

4.1 Signal Integrity of the Transferred Signal

The following sections describe the effect that bandwidth and the type of connection have on signal integrity.

4.1.1 Bandwidth

The bandwidth BW of a probe is one of its specific parameters. The bandwidth of the probe and the bandwidth of the base unit together form the system bandwidth. The following explanations refer to the probe itself, but can also be applied to the entire system.

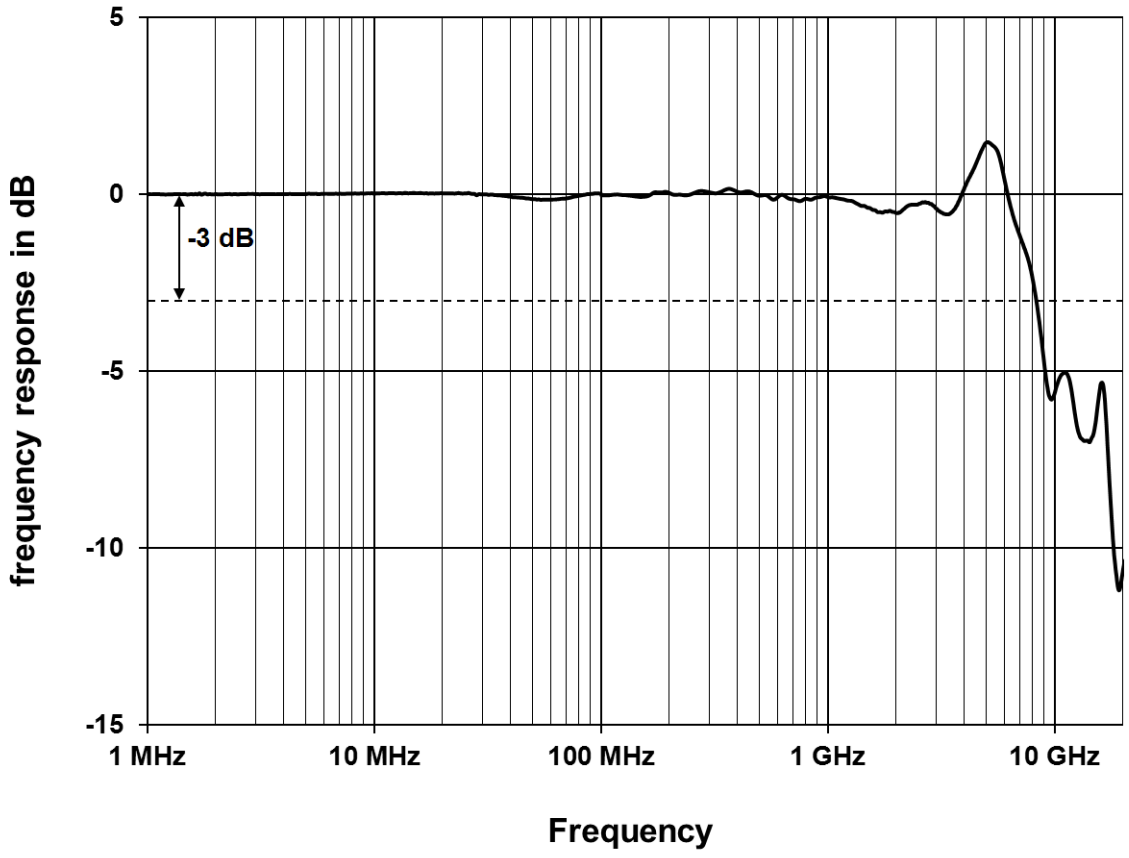


Fig. 4-2: Amplitude frequency response of the R&S RT-ZZ80

The bandwidth

- Specifies the maximum frequency at which a purely sinusoidal signal is still transferred at 70 % (–3 dB) of its amplitude.
  See figure 4-2

- Specifies the transferable spectrum for other waveforms. E.g. with square wave signals, the fifth harmonic should still be within the bandwidth for a high signal integrity.
- Determines the minimum measurable signal rise time. The rise time t_{rise} of the probe is inversely proportional to its bandwidth. The following approximation applies:

$$t_{rise} \approx \frac{0.5}{BW}$$

The figure 4-3 shows a typical step response of an R&S RT-ZZ80 transmission line probe.

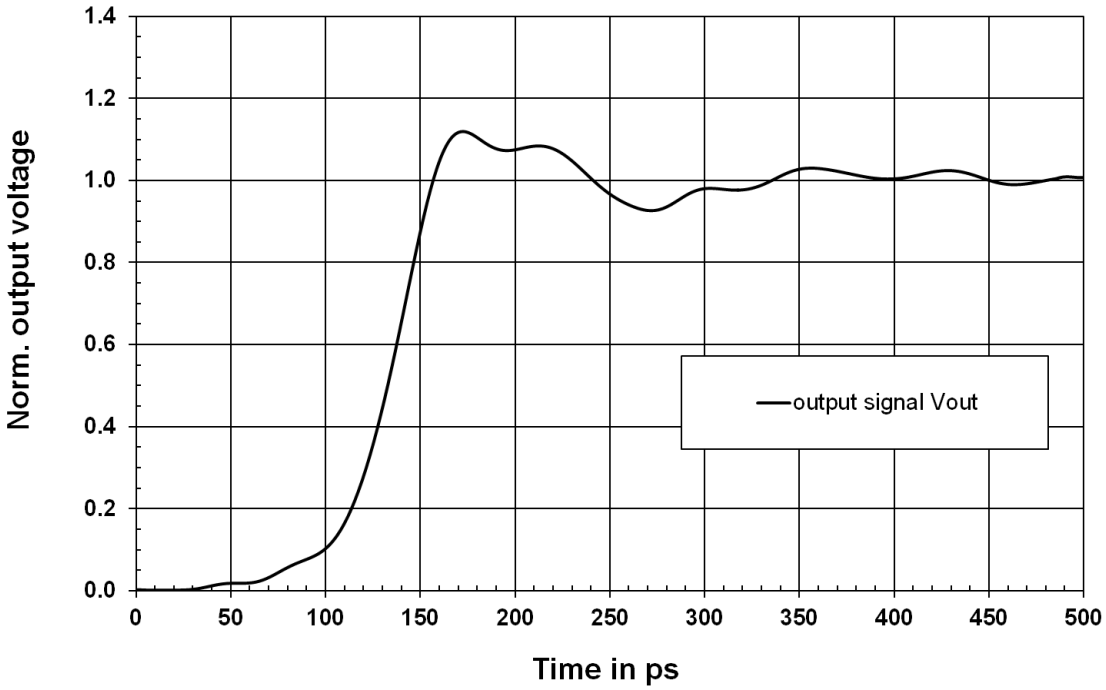


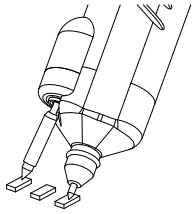
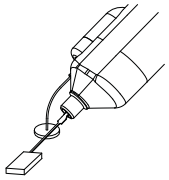
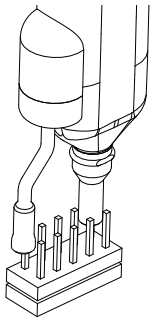
Fig. 4-3: Step response of the R&S RT-ZZ80

In addition to bandwidth, a constant amplitude frequency response of the probe is decisive for high signal integrity. The figure 4-2 shows the typical amplitude frequency response of an R&S RT-ZZ80 transmission line probe.

4.1.2 Performance with Different Connection Types

The table 4-2 shows three types of connection between probe and DUT as well as the associated rise times, bandwidths, input impedances and overshoots. The longer the connection to the DUT, the higher the connection inductance L_{con}.

Table 4-2: Typical rise time, bandwidth, input impedance and overshoot with different connection types

No	Connection Type	Connection			Rise time	Band-width	Min. input impedance $\|Z_{min}\|$	Over-shoot
		Signal socket	Ground socket					
1		signal pin	ground pin, pogo	wide spacing	55 ps	7.5 GHz	100 Ω	12 %
				narrow spacing	49 ps	9.5 GHz	80 Ω	24 %
2		signal pin, solder in	ground pin, solder in	short pins	54 ps	8 GHz	130 Ω	11 %
				long pins	53 ps	5 GHz	165 Ω	14 %
3		signal adapter, square pin	ground adapter, square pin	wide spacing	56 ps	8,5 GHz	100 Ω	12 %
				narrow spacing	49 ps	11 GHz	45 Ω	32 %

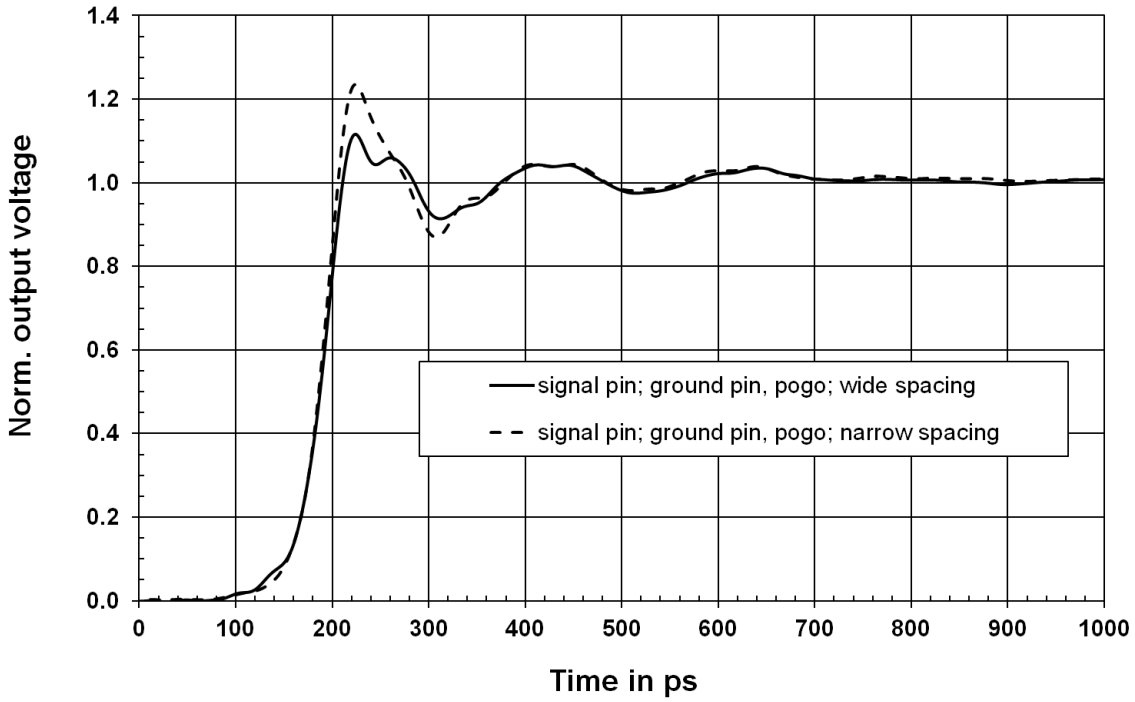


Fig. 4-4: Step response of the R&S RT-ZZ80 with a type 1 connection

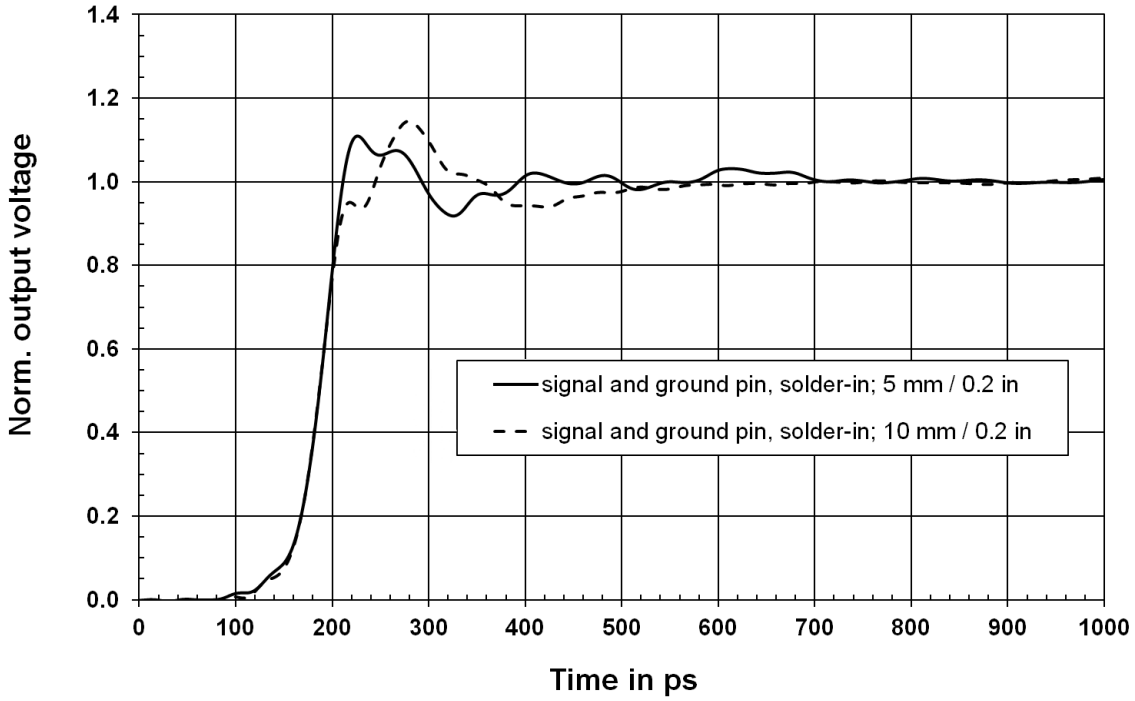


Fig. 4-5: Step response of the R&S RT-ZZ80 with a type 2 connection

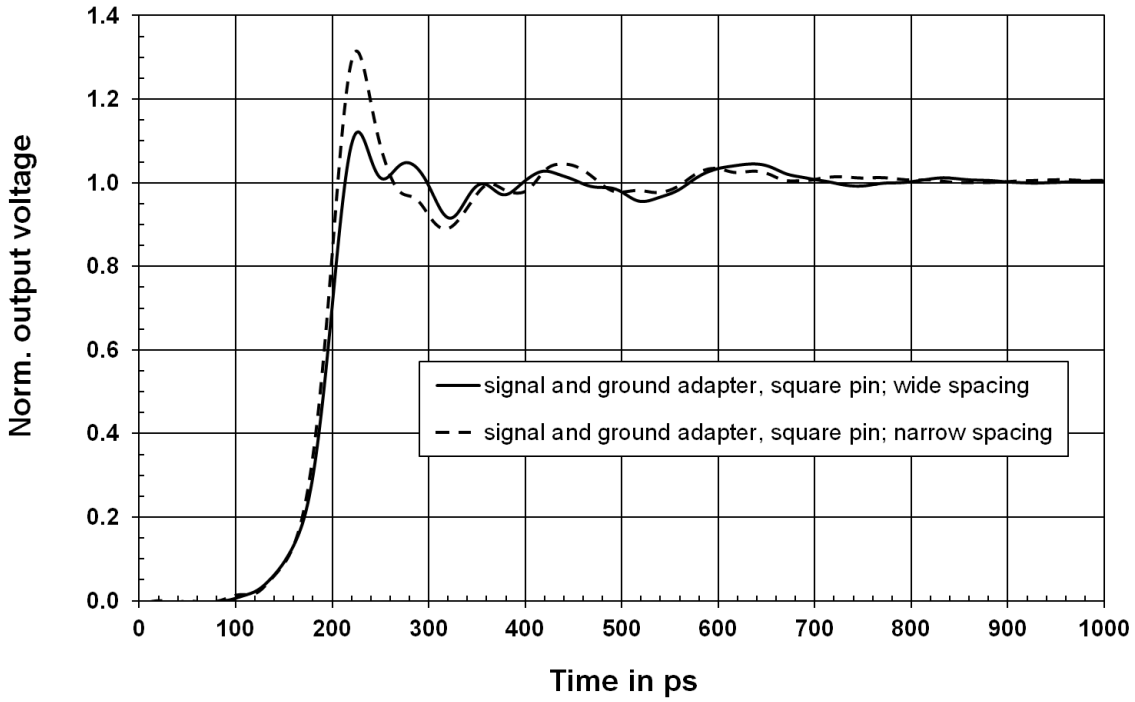


Fig. 4-6: Step response of the R&S RT-ZZ80 with a type 3 connection

4.2 Signal Loading of the Input Signal

The previous section dealt with the transfer function and step response of the probe. This section describes how the probe influences the input signal.

4.2.1 Transmission Line Probes

Traditional passive probes have a high input impedance at DC (typically from 1 MΩ to 10 MΩ) that quickly decreases with rising frequency. For DC, the load of the DUT is usually negligible, but high-frequency signals are loaded all the more.

On the contrary, transmission line probes have a very low input impedance at DC, typically from a few 100 Ω to 1 kΩ. This results in a significant higher load of the DUT at DC than the load caused by a traditional passive probe and can lead to a malfunction of the circuit.

NOTICE

Application range of transmission line probes

Use the R&S RT-ZZ80 only for measurements of low-impedance sources, preferably in 50 Ω or 75 Ω impedance controlled environments.

The advantage of transmission line probes is the nearly constant input impedance over the frequency range, even at very high frequencies. Thus, transmission line probes are qualified also for measurements of very broadband signals, which cannot be measured using traditional passive probes.

4.2.2 Input Impedance

The input signal loading caused by the probe is determined by its input impedance Z_{in}. The figure 4-1 presents an equivalent circuit model.

Z_{in} consists of the following probe-specific parameters.

- Input resistance R_{in}
- Input capacitance C_{in}
- Minimum input impedance $|Z_{min}|$

The resulting input impedance versus frequency is indicated in figure 4-7. The trace shows three characteristic areas that can be assigned to R_{in}, C_{in}, and $|Z_{min}|$. The resulting loading of a step signal at the input of the probe is given in figure 4-8.

The connection inductance L_{con} has only a minor effect on the signal loading and is therefore not taken into account in the following.

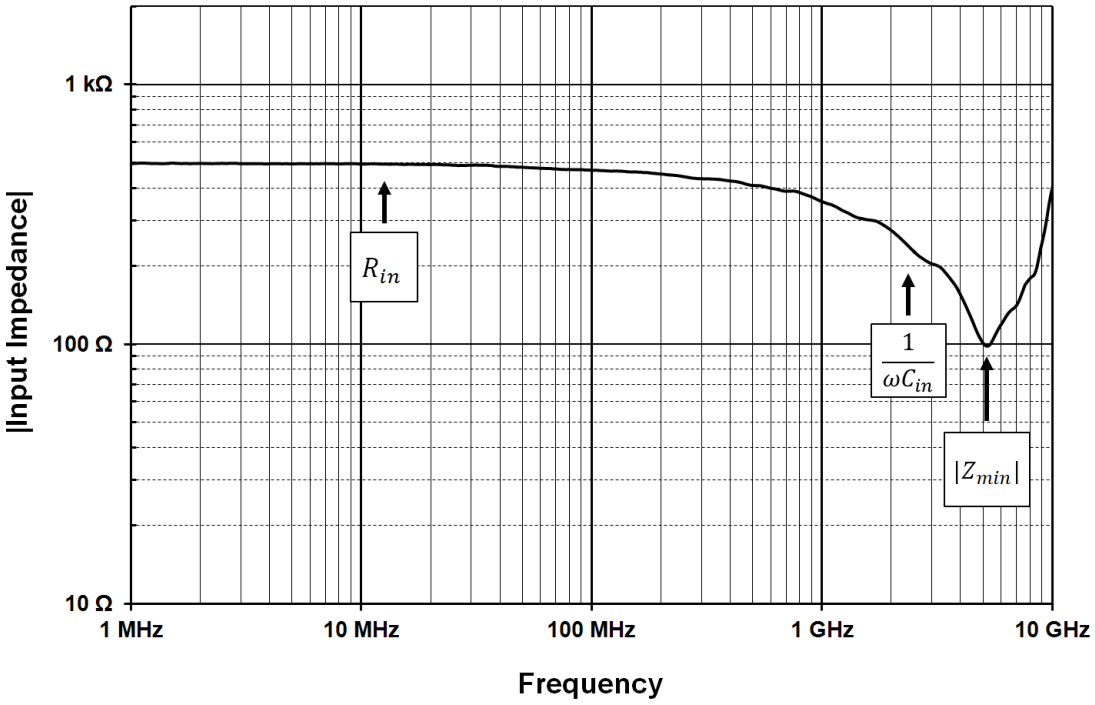


Fig. 4-7: Magnitude of the input impedance of the R&S RT-ZZ80 probe as a function of frequency

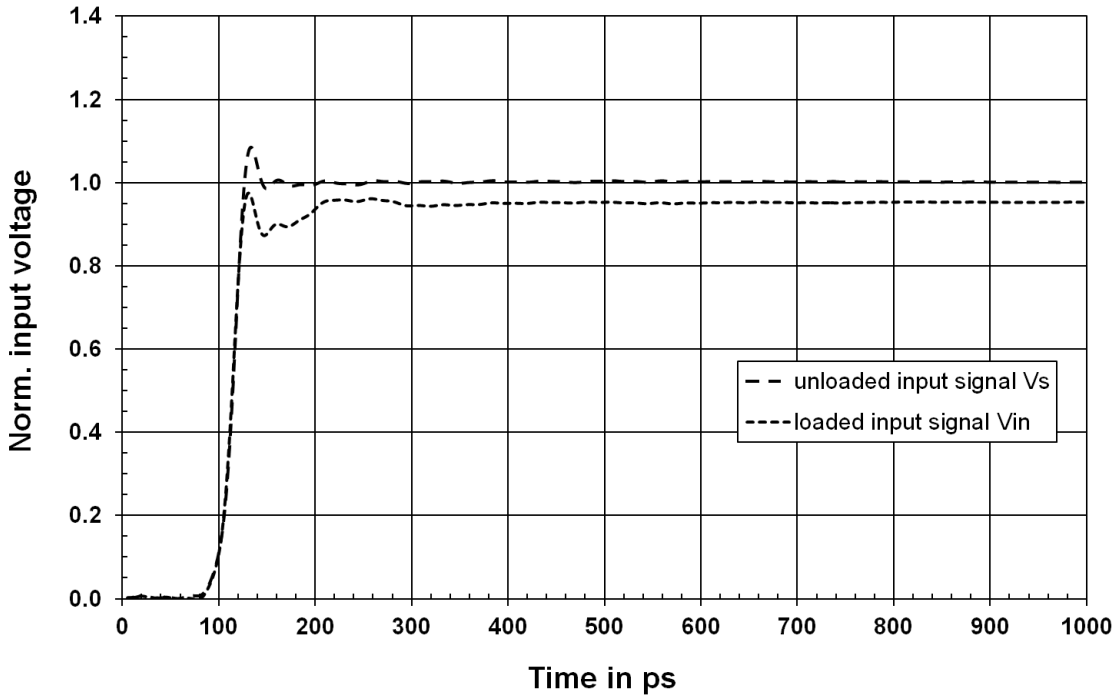


Fig. 4-8: Signal loading caused by the R&S RT-ZZ80 probe at an effective source impedance of 25 Ω

4.2.2.1 Input Resistance R_{in}

The input resistance determines the loading of the DUT at DC and frequencies up to 1 GHz. In this area, the input impedance is near-constant. For DC signals, the input resistance is 500 Ω.

4.2.2.2 Input Capacitance C_{in} and Minimum Input Impedance $|Z_{min}|$

The input capacitance C_{in} causes the input impedance to decrease for high frequencies above 1 GHz. C_{in} is very low - typically under 300 fF. This low input capacitance minimizes the load of high-frequency signals.

The minimum input impedance $|Z_{min}|$ mainly depends on the the connection inductance and the connection type. An overview is given in table 4-2.

4.3 Attenuation Dependence on Source Impedance

The previous sections made clear that probes exert a load on the signal to be measured and change its characteristic. The signal at the test point where the probe makes contact (V_{in}) is therefore different from the signal that was present before the probe was connected (V_S).

In contrast to most other probes, the load of the R&S RT-ZZ80 is not negligible for DC and low-frequency signals. Therefore, the attenuation of the probe depends on the impedance of the signal source. The figure 4-9 shows the unloaded and loaded input voltages as well as the output voltage of the probe in an 50 Ω environment.

For the R&S RT-ZZ80, the output signal is a good representation of the loaded input signal. The loaded input signal differs from the unloaded signal mainly by a lower voltage swing, while the shapes of both signals are almost identical.

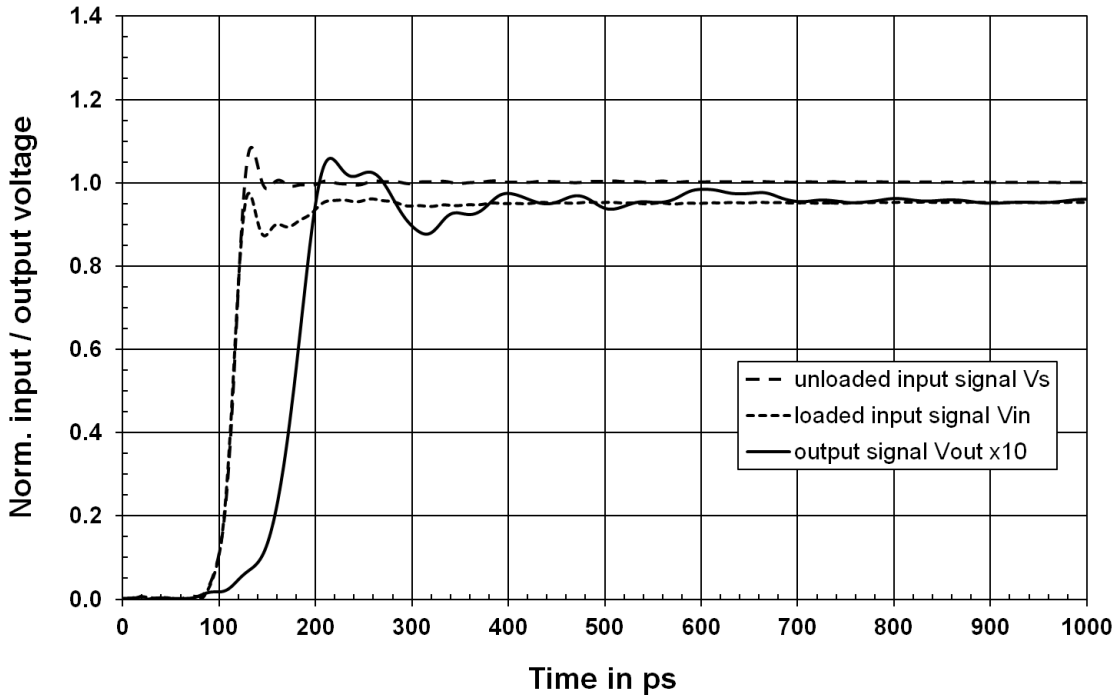


Fig. 4-9: Input and output signals at an effective source imedance of 25 Ω

To calculate the exact attenuation of the probe, use the following equation:

$$\frac{U_{out}}{U_{in}} = \frac{50\,\Omega}{Z_{in} + R'_S}$$

U_{out} : output voltage
U_{in} : unloaded input voltage
Z_{in} : input impedance
R'_S : effective source impedance

Example for an 50 Ω environment:

$$\frac{U_{out}}{U_{in}} = \frac{50\,\Omega}{500\,\Omega + 25\,\Omega} \approx 0.0952$$

5 Maintenance and Service

5.1 Service Strategy

The R&S RT-ZZ80 transmission line probe is a high-precision, high-performance instrument that extends the limits of today's technological possibilities. Like all Rohde & Schwarz instruments, the R&S RT-ZZ80 transmission line probe is of high quality and requires only minimum service and repair. However, if the probe needs to be serviced, contact your Rohde & Schwarz service center. Return a defective probe to the Rohde & Schwarz service center for diagnosis and exchange.

You can return the R&S RT-ZZ80 transmission line probe for calibration. The service personnel will then perform the required tests.

5.2 Returning the Probe for Servicing

Use the original packaging to return the R&S RT-ZZ80 transmission line probe to your Rohde & Schwarz service center.

If you cannot use the original packaging, consider the following:

1. Use a sufficiently sized box.
2. Protect the probe from damage and moisture (e.g. with bubble wrap).
3. Use some kind of protective material (e.g. crumpled newspaper) to stabilize the probe inside the box.
4. Seal the box with tape.
5. Address the package to your nearest Rohde & Schwarz service center.

5.3 Cleaning

To clean the exterior of the probe, use a soft cloth moistened with either distilled water or isopropyl alcohol. Before using the probe again, make sure to dry it completely.

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances that may damage the instrument; for example, solvent may damage the labeling or plastic parts.

Never use cleaning agents such as solvents (thinners, acetone, etc.), acids, bases or other substances

5.4 Calibration Interval

The recommended calibration interval is two years. For servicing, send the probe to your nearest Rohde & Schwarz service center (see chapter 5.2, "Returning the Probe for Servicing", on page 33).

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